

Petrified Forest National Park



Teacher's Resource Packet

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Welcome to your outdoor classroom!

Thank you for visiting Petrified Forest with your students and supporting your national parks. We are glad you are taking the opportunity to use the park resources to enhance your classroom experience. We have developed our programs to address many of the science curriculum standards for Arizona Department of Education and the national Common Core. This packet will help prepare you for your visit, and provide additional post-visit learning opportunities. All the items in the packet are yours to keep.

Your students will gain the most from their field trip if they spend some time preparing for it. There are several hours of pre-visit activities in this packet, such as information on selected topics, classroom exercises, and readings.

The purpose of this pre-visit material is to:

- give instructors ideas and information for developing classroom, pre-visit programs and activities,
- stimulate the students' interest, build anticipation for the visit,
- lay a foundation of knowledge that the National Park Service program leader can build upon,
- and provide learning opportunities for the students following their visit.

Contact Information:

Petrified Forest National Park
1 Park Rd. Unit 2217
Petrified Forest, AZ 86028
(928)524-6228 x238

Reservations for Ranger Led Programs Due to a small staff, reservations for educational programs should be made well in advance. There is no charge for any of the programs. You can download an application for an Educational Fee Waiver request by going to the park website [here](#). (Current information on transportation grants is also available on the page webpage.)

Please review the contents of this packet carefully. If there is a question or concern about the information please contact the Education Program Coordinator at 928-524-6228 x238 as soon as possible.

Ranger-Led Field Trips

Petrified Forest National Park offers a variety of free, ranger-led, curriculum-based programs. These programs are correlated to Arizona and national learning standards, and provide students with an engaging learning experience by utilizing the park's natural and cultural resources as teaching tools. Programs are 1 to 1.5 hours long and are available between 8:30am and 4pm, Tuesday through Thursday.

All programs require pre-registration. To arrange a special ranger program, please contact the education program coordinator at (928)524-6228 x238. Ranger availability is not guaranteed. For better scheduling options please contact us at least three weeks prior to your planned visit date.

The following ranger-led programs are offered by-request in the park:

Every Kid in a Park: Grade 4, 30 minutes in the park (45-60 min pre-visit lesson)

- This program is intended as a supplement to the Every Kid in a Park lesson found on www.everykidinapark.gov. Students meet a ranger in the park for a 30 minute question and answer session. This program can be conducted at any overlook or trail in the park. 4th grader passes are issued to the class at the end of the program

Simulated Fossil Excavation: Grades 1–5, 90-120 minutes

- Students will experience the thrill of discovery while learning how to see the bigger picture of an ancient ecosystem. They will map, measure, and identify fossilized remains of Triassic animals and plants. (real and replica fossils are available) This program is the culmination of the Rocking through the Ages curriculum but can also be conducted as a stand-alone activity. Group size is limited to 25 students.

Simulated Archeology Excavation: Grades 1 –5, 90-120 minutes

- Students engage in archeological field techniques while learning to measure, map, and identify artifacts of the ancestral Puebloan culture. This program is the culmination of the Rocking through the Ages curriculum but can also be conducted as a stand-alone activity. Group size is limited to 25 students.

Geology/Clam Beds Hike: Grades 3-8, 60-90 minutes

- Students hike with a ranger into the badlands of Petrified Forest where they learn how to make observations, read the rocks around them, discover fossil evidence and discuss ideas about Arizona's geologic past. Group Size is limited to 25 students.

Museum Detectives: Grades 3-8, 60 minutes

- This program takes place at the Rainbow Forest Museum. Students use fossil replicas to observe, and identify skeletal anatomy of Triassic reptiles and dinosaurs. The activity is followed by a short presentation of their findings to the group.

Ask a Ranger: Grades K-12, 30 minutes

- Students prepare thoughtful questions ahead of time and spend a half hour with a ranger discussing Petrified Forest geology, paleontology, ecology, and human history.

Special topic programs can also be arranged by contacting the education program coordinator at 928-524-6228 ex 238.

Petrified Forest National Park on the Web:

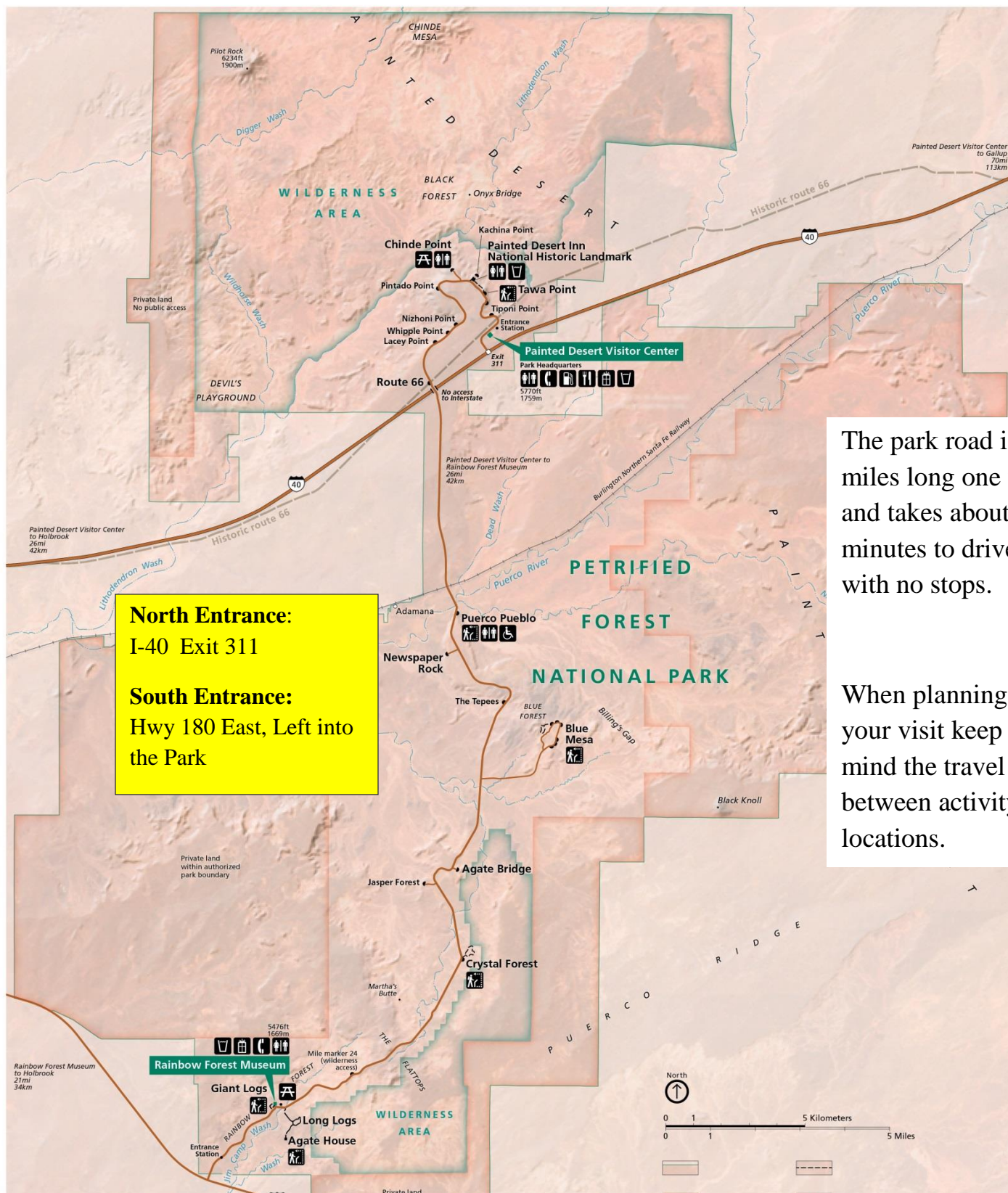
Twitter: <https://twitter.com/PetrifiedNPS>

Facebook: <https://www.facebook.com/PetrifiedForestNPS>

Flickr: <https://www.flickr.com/photos/petrifiedforestnps>

You Tube: <http://www.youtube.com/channel/UCNu0VLpgJZWl6MhW1yPPPw/feed>

Instagram: <https://www.instagram.com/explore/locations/225678632/>



The park road is 28 miles long one way and takes about 45 minutes to drive with no stops.

When planning your visit keep in mind the travel time between activity locations.

Stop at the Painted Desert Visitor Center (north entrance) or the Rainbow Forest Museum (south entrance) for restrooms, to fill water bottles, and to watch the 18-minute orientation movie, *Timeless Impressions*. If you have an approved Educational Fee Waiver, present it at the entrance station. *Each vehicle in your group must have a copy of the fee waiver.

Parking: Buses should park in long spaces designated for larger vehicles where available.

Petrified Forest National Park
Environmental Education Program
PRE-VISIT CHECKLIST (Self-Guided)

- ☐ Education fee waiver sent to the park.
- ☐ Approved education fee waiver received from the park. A copy must be provided for each vehicle entering the park.
- ☐ Rules and regulations for education groups within Petrified Forest National Park are understood by students.
- ☐ Students understand what they need to wear/bring:
 - Comfortable clothes that can get
 - Closed-toe shoes (with ankle support if hiking)
 - Bad weather gear
 - Water (at least 1 quart per person)
 - Hat and sunscreen
 - Notebook and pencil(if applicable)
- ☐ Chaperones, at least one for each student group, recruited and confirmed.
- ☐ Transportation arrangements made.
- ☐ Lunch arrangements made.

Petrified Forest National Park
Environmental Education Program
PRE-VISIT CHECKLIST (Ranger Guided Programs)

- ☐ Education fee waiver sent to the park.
- ☐ Approved education fee waiver received from the park. A copy must be provided for each vehicle entering the park.
- ☐ Pre-visit activities completed (If using Rockin' Through the Ages Curriculum; Students have developed compass and mapping skills with an understanding of field trip goals and objectives)
- ☐ Rules and regulations for education groups within Petrified Forest National Park are understood by students.
- ☐ Students understand what they need to wear/bring:
 - Comfortable clothes that can get dirty (long shorts or pants for simulated digs)
 - Closed-toe shoes
 - Bad weather gear
 - Water (**at least 1 quart per person**)
 - Hat and sunscreen
 - Notebook and pencil(For Rockin' Curriculum only)
- ☐ Students divided into 8 field groups for simulated digs.
- ☐ Chaperones, at least one for each student field group, recruited and confirmed.
- ☐ Transportation arrangements made.
- ☐ Lunch arrangements made.
- ☐ Confirmation of visit received from the park.
- ☐ _____
- ☐ _____



RULES, REGULATIONS, AND SAFETY POINTS FOR SCHOOL GROUPS

In order to make your trip as enjoyable and successful as possible, the following rules, regulations, and safety points must be followed by all members of your group.

- All natural and cultural resources within national parks are protected by federal law. **Collection of park resources is illegal and subject to a \$325.00 minimum fine.** This includes not only petrified wood and archeological artifacts, but also rocks, plants, and animals. The park has a *zero loss* policy, so even the smallest pieces count!



- If you pick up petrified wood, rocks, sticks, etc. to have a closer look at them, be sure to put them back exactly where you found them. Moving fossils by just a few feet can displace them out of scientific context by millions of years.

- Dispose of trash properly. Most viewpoints have receptacles and recycling bins for your use. Please make sure all trash is within the receptacle and the lid is closed. Ravens can pull out an entire garbage bag if any of it is exposed! If you see trash left by someone else and want to help us out by picking it up and putting it in the trash we greatly appreciate this as well.



- Don't feed the wildlife. Wild animals can become dependent on humans for food and forget how to forage for themselves. When humans are not around, they may starve! Wild animals can also bite and may carry diseases. If you get a deep puncture wound, you must visit the doctor for a tetanus shot to prevent infection.



- Stay on designated trails or follow directly behind the park ranger when off-trail at field study sites. The plants in our high plateau short grass prairie environment grow by the inch and are destroyed by the foot. Don't let it be your foot! Stay with your group. It's a big place to get lost in.



- Be respectful of other visitors. Try to keep noise levels down and don't yell to each other across large areas. Quiet voices are especially appreciated at The Painted Desert Visitor Center, The Rainbow Forest Museum, and The Painted Desert Inn. Ranger talks may be going on at different times of the day in these buildings and other visitors will be listening in. If you have a large group, please split the group up and take turns when visiting inside these buildings. If you are on a ranger guided program please **do not** have Ipods or headphones on for the duration of the program.

- Watch your step. Don't go beyond protective fencing or guardrails. Falling accidents occur when people get too close to the edge of steep slopes and cliffs. Please don't throw rocks over the edge of cliffs. Hikers or animals may be below. Be safe. Average elevation within the park is 5,600 feet, so protect yourself from sunburn, even in the winter months. Drink water and eat lunch.



- Lightning can be an electrifying experience. Avoid high observation sights, open areas, and rocky overhangs when lightning or thunder is **around**. **Vehicles and buildings (not shade shelters) are the safest refuge during thunderstorms.**

LOGISTICS FOR SCHOOL GROUPS



First Aid: If you have any medical problems during your program, let the park ranger know immediately. If a medical problem occurs after the park ranger has left your group, contact any park employee or, **in case of an emergency call 911** (This will contact Navajo County dispatch who dispatches for our Law Enforcement/EMT Rangers). First aid supplies are located at Painted Desert Visitor Center, Painted Desert Inn, and Rainbow Forest Museum.



Restrooms: Year-round facilities are found throughout the park at the Painted Desert Visitor Center, Painted Desert Inn, Chinde Point, Puerco Pueblo, and Rainbow Forest Museum. The restrooms at Agate Bridge are now permanently closed.



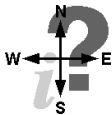
Picnic Areas: Sheltered picnic areas are located at Chinde Point and Rainbow Forest. You are welcome to stop and have lunch at any of the other viewpoints, provided you remain in the developed area and do not picnic off-trail. Please help us keep the park clean and ensure that all trash is disposed of properly. Please *do not allow students to feed the animals*, including ravens.



Water Fountains: Each member of your group should carry a water bottle while in the park. Water bottle fill up stations are located at the Painted Desert Visitor Center, Painted Desert Inn, and Rainbow Forest Museum.



Food Service: The Ortega Company operates a year-round restaurant and snack bar next to the Painted Desert Visitor Center. If you would like Ortega to make box lunches for your group please call ahead to make arrangements at (928) 524-3756.



Lost and Found: If anyone in your group misplaces something or finds a lost item to turn in, contact the Painted Desert Visitor Center, Painted Desert Inn, or Rainbow Forest Museum as soon as possible. You may also call (928) 524-6228.



Park Hours: The park hours change throughout the year (MST) and are different than the visitor center and museum hours. For information on current park hours call us at (928) 524-6228 x236 or visit us on the web at www.nps.gov/pefo. ENJOY YOUR VISIT!



Chaperone Guidelines and Responsibilities for Field Trips

Hands on and in park experiences are important aspects of learning about national parks. If you are selected to help with a field trip, realize that you are an important partner in the Parks as Classrooms program.

We need your participation and cooperation to make the trip a success and will be asking the following of you:

- If possible, each adult should be assigned to a specific group of students. Each chaperone should know which students he or she is directly responsible for.
- Help control your students: Chaperones should take the lead in getting the students prepared: make sure they have everything they'll need before they leave the bus, lead them to the restrooms, and supervise them throughout the visit (including during a ranger led program).
- Please ride on the school bus. It makes getting everyone through the entrance station much easier and avoids parking problems.
- Assist with safety. It will be one of your primary duties as a chaperone.
- Be an active participant. Students will want to participate if you do.
- Provide guidance to students for lunch and clean-up.
- Help set boundaries and provide leadership.
- Guide the learning process and help focus students on the activity or speaker.
- Please read the Rules of the Park document found on our website at <http://www.nps.gov/pefo/forteachers/plan-a-field-trip.htm> so you know what example to set for the students.

Most importantly go with the flow, adapt, and have fun in Petrified Forest. The students pick up on how you react. If you are having fun, they will too.

Thank you!

Petrified Forest Background Information

Fast Facts

Petrified Forest was originally established as a national monument on December 8th, 1906 by President Theodore Roosevelt. President Roosevelt stated that, "...the mineralized remains of Mesozoic forests...are of the greatest scientific interest and value and it appears that the public good would be promoted by reserving these deposits of fossilized wood as a National Monument with as much land as may be necessary for the proper protection thereof." Petrified Forest then became a national park on December 9th, 1962. President Dwight D. Eisenhower first approved the legislation in 1958, but President John F. Kennedy saw it completed in 1962. First protected as one of the world's most colorful and largest deposits of petrified wood, the park now protects far more including archeology that represents more than 13,000 years of human history. First and foremost, Petrified Forest is a science park!

- The park contains over 140,000 acres (over 218 square miles). Within the park there is even 50,000 acres of designated wilderness where no roads or trails will ever be built.
- Visitor facilities include the Rainbow Forest Museum which features fossil exhibits, The Painted Desert Visitor Center, and the Painted Desert Inn National Historic Landmark. Food, souvenirs, and other services are available at both sides of the park.
- Theodore Roosevelt created Petrified Forest National Monument on Dec 8th, 1906. Petrified Forest was designated as a national park on December, 9th 1962.
- Annual visitation to Petrified Forest National Park fluctuates from year to year but recent averages show around 750,000 visitors a year.
- In 2004, congress created a new boundary line for the park saying that it could be as large as 221,551 acres. Currently Petrified Forest comprises about 146,500 acres of land within this boundary.
- The petrified logs in the park are fossilized tropical conifer trees from the Late Triassic epoch. They are over 200 million years old. They formed when dead trees became buried by river sediments then were infiltrated by silica from volcanic ash mixed in with the sediments which recrystallized into quartz and replaced the organic material.
- The brilliant colors in the petrified logs come mainly from three minerals; pure quartz (silicon dioxide) is white or clear, manganese oxides form blue, purple, black, and brown, and iron oxides provide yellow, red, orange, and brown.
- The main environment of the park is an Intermountain Basin semi-arid steppe and grassland (shortgrass prairie).
- Hundreds of species of plants and animals can be found in Petrified Forest National Park. Residents include pronghorn, Gunnison's prairie dog, coyote,

bobcat, bullsnake, Arizona tiger salamander, meadowlark, golden eagle, cottonwood tree, yucca, four-wing salt bush, vetch, cliffrose, blue grama grass, and many more.

- There are nearly a thousand archeological and historic sites in Petrified Forest national park representing over 13,000 years of human history. New discoveries are made every year!
- Puerco Pueblo was built by the ancestral Puebloan people who occupied it between A.D. 1250 and 1380.
- Agate House was occupied approximately A.D. 1100-1150 and was built out of pieces of petrified wood.
- Herbert David Lore built the Painted Desert Inn and opened it in 1924. The National Park Service bought the building from Lore in 1936 and reconstructed it into a Pueblo Revival style building using designs by NPS architect Lyle Bennett in the late 1930's. The Civilian Conservation Corps (CCC) was brought in to do the work. The restaurant operations continued in the building until 1963. The building is now a National Historic Landmark and is open as a museum.
- Petrified Forest National Park is the only national park site that contains a segment of Historic Rt. 66, though the pavement no longer exists within the park. Part of the National Old Trails Highway and the Beale Wagon Road also passed through the park.
- The Chinle Formation of the Late Triassic epoch (over 200 million years ago) is the main geologic formation exposed in the park.
- The Bidahochi Formation basalt outcrops, located at the north end of the park, formed during the Miocene and Pliocene epochs in the Cenozoic era 3-8 million years ago.
- Petrified Forest has more than 60 holotypes of extinct plants and animals in its fossil collection. A holotype is the specimen used to originally describe a particular species and all subsequent fossils are then compared to it.

Petrified Forest National Park is Considered one of the Best late Triassic fossil localities in the world and is on the Tentative List to become a UNESCO World Heritage Site.

Geology

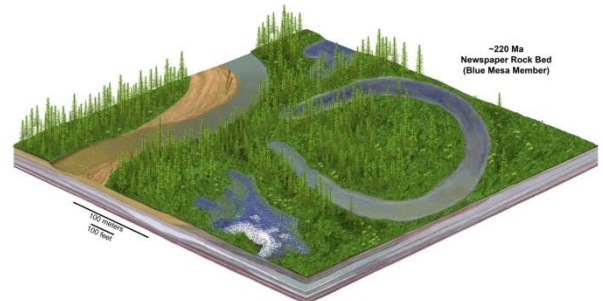
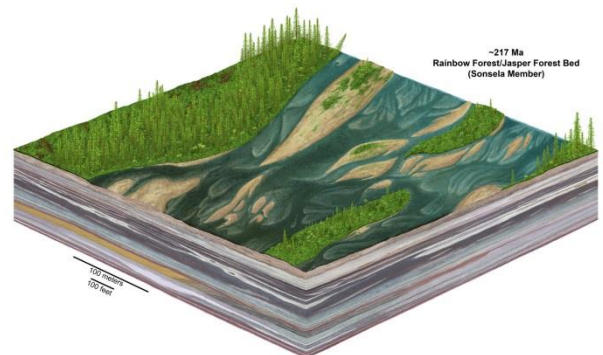
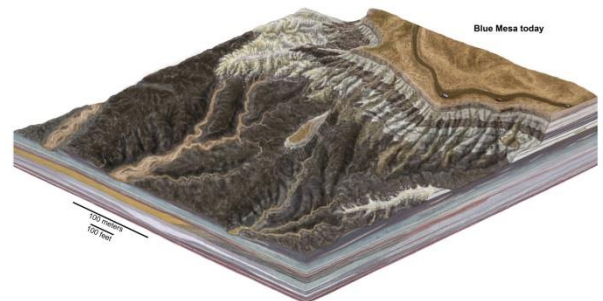


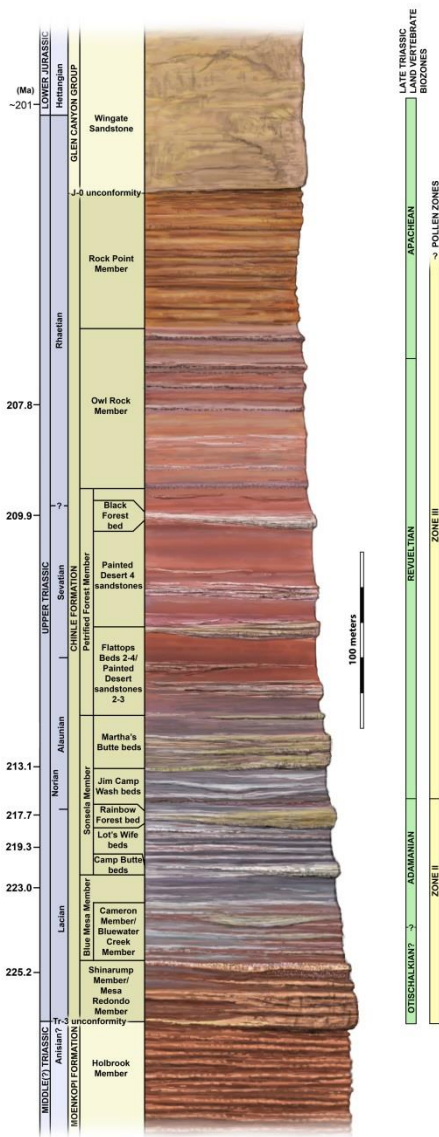
As part of the Painted Desert, Petrified Forest National Park features a strangely beautiful landscape. Erosion has sculpted and shaped intriguing landforms, revealing a treasure trove of fossils within multi-colored layers. The rocks reveal an enthralling chronicle of time that is unfolding and ever-changing.

What can the rocks tell us? Think of the colorful layers of Petrified Forest as pages in a massive book. As the pages are turned, we discover that the words are part of a language we don't completely understand. The pictures

in the book help, but we must put together the story of this ancient book with fragmented clues. The first chapter of this geological text is the **Chinle Formation**.

During the Late Triassic Epoch large river systems flowed northwest through this region to the sea, which was located in what would later become Nevada. These rivers deposited thick layers (over 900 feet/300 meters) of silt, sand, and gravel burying their channels and floodplains. Modern erosional forces have re-exposed these deposits as the colorful badland hills, flat-topped mesas, and sculptured buttes of the Chinle Formation, which makes up a large portion of the Painted Desert region of Arizona.





Within Petrified Forest National Park, the layers of the Chinle Formation are divided into members:

The Mesa Redondo Member consists mainly of reddish sandstones with some minor mudstones. This layer represents the lowest (and thus oldest) member of the Chinle Formation found in the park. Unfortunately, it is restricted only to a small area in the Tepees section of the park. The Mesa Redondo Member is approximately 226 million years old.

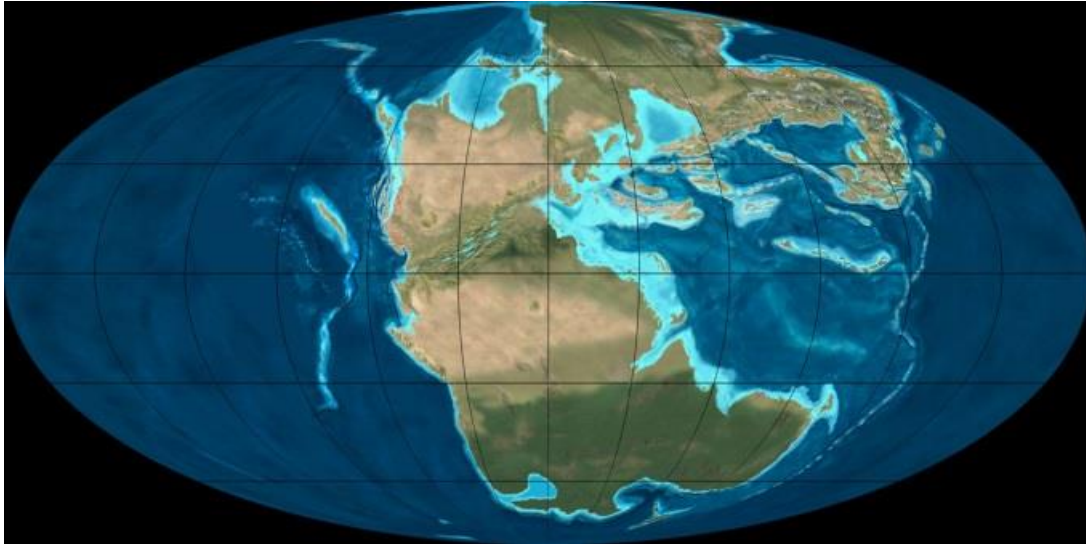
The Blue Mesa Member consists of thick deposits of grey, blue, purple, and green mudstones and minor sandstone beds, the most prominent of which is the Newspaper Rock Bed. This unit is best exposed in the Tepees area of the park. The Blue Mesa Member is approximately 223-225 million years old.

The Sonsela Member consists of five parts: 1) the lower Camp Butte beds consisting of white sandstone and conglomerates; 2) the Lot's Wife beds consisting of purple mudstones and gray sandstones; 3) the Jasper Forest bed (at Crystal and Jasper Forests, Blue Mesa) and the Rainbow Forest Bed (at Rainbow Forest), consists of thick gravelly sandstones and conglomerates which contain the majority of the colorful petrified wood; 4) the Jim Camp Wash beds, another unit of mudstone and sandstone with numerous calcareous lenses; and 5) the Martha's Butte beds, purple mudstones and massive brown colored

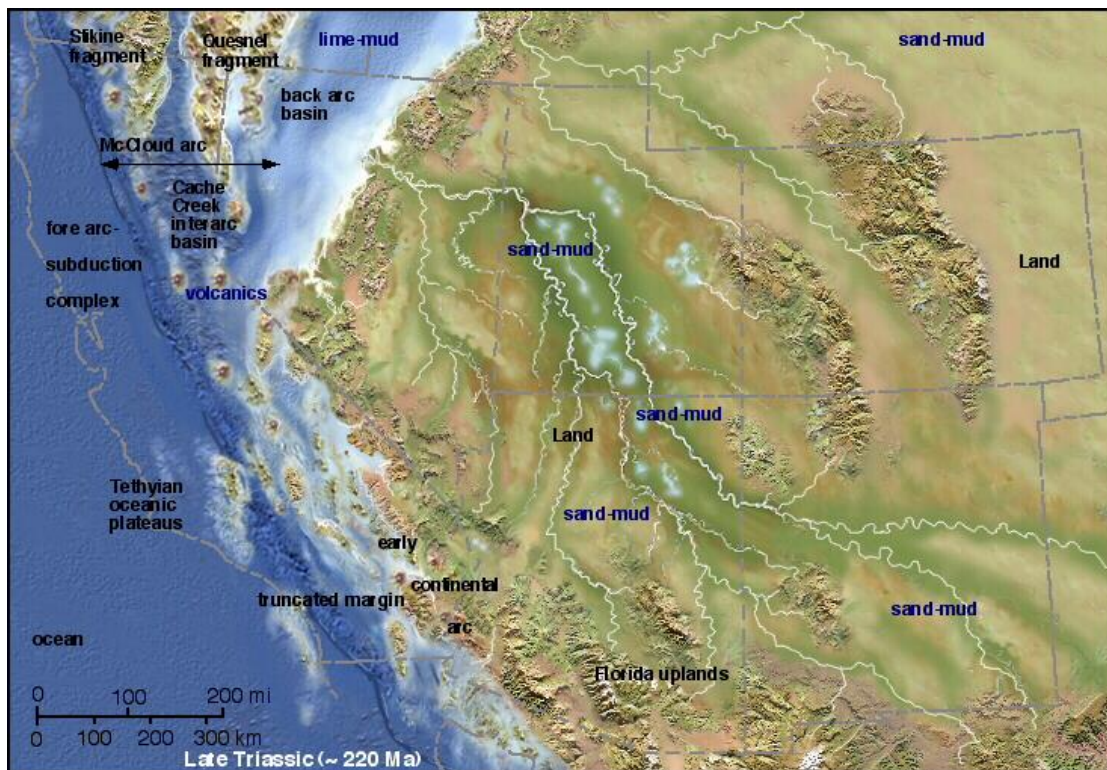
sandstones termed the Flattops One Sandstones. The Sonsela Member was deposited about 213-219 million years old.

The Petrified Forest Member consists of thick sequences of reddish mudstones and brown sandstone layers. This member is exposed in the Flattops and the red hills of the Painted Desert. The Black Forest Bed, part of the Petrified Forest Member north of Kachina Point, has been determined to be about 209 million years old.

The Owl Rock Member consists of pinkish-orange mudstones mixed with hard, thin layers of limestone. This member is exposed at Chinde Mesa at the northernmost border of the park. The Owl Rock Member is approximately 207 million years old.



During the Late Triassic, this region was located on the southwestern edge of the supercontinent Pangaea and just north of the equator. Evidence from ancient soils as well as fossil plants and animals indicates that the climate was humid and sub-tropical during the Late Triassic. The sedimentary layers of the Chinle Formation consist of sandstone, mudstone, and conglomerate deposited by a large river system that had cycles of droughts and floods, similar to those affecting many modern river systems.

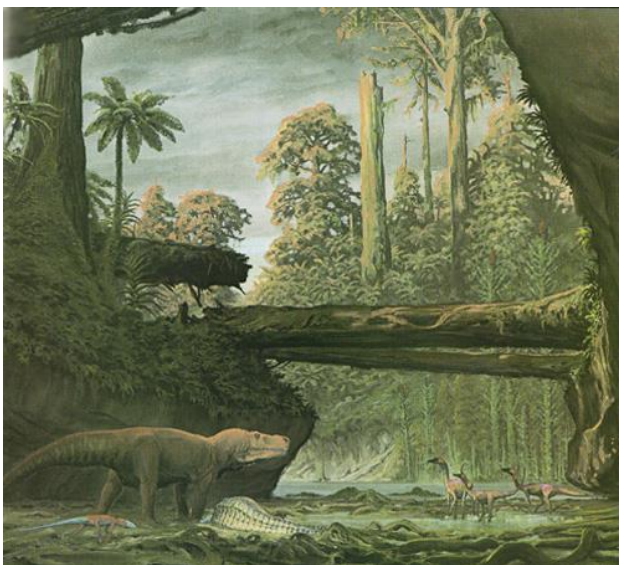




The colorful bands in the Chinle Formation, which give the Painted Desert its name, represent ancient soil horizons. The coloration is due to the presence of various minerals. While the red and green layers generally contain the same amount of iron and manganese, differences in color depend on the position of the groundwater table when the ancient soils were formed. In soils where the water table was high, a reducing environment existed due to a lack of oxygen in the sediments, giving the iron minerals in the soil a greenish or bluish hue. The reddish soils were formed where the water table fluctuated, allowing the iron minerals to oxidize (rust).

Paleontology

Petrified Forest National Park contains a wealth of fossils from the Late Triassic epoch that are



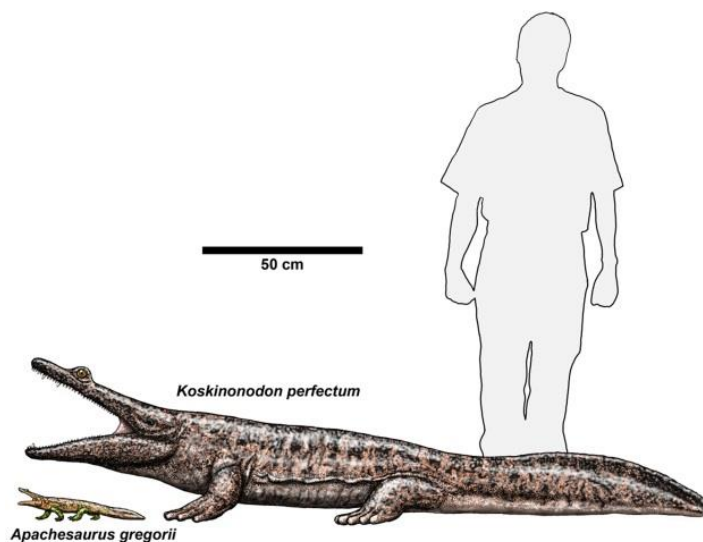
over 200 million years old. These fossils are contained in the layers of the Chinle Formation, also known as The Painted Desert. The process of science and field work is very important to telling the story of Petrified Forest NP because the first paleontological research began in the early 1900's and continues today. Both the geology and paleontology within the park have been and continue to be extensively studied. The park strives to foster public appreciation for the new information that is learned as part of a larger appreciation for protecting and learning in public lands.

Paleontology is a science that investigates the remains of ancient life and the changing forms of life through time. Paleontologists must have an understanding of geology, biology, and ecology to interpret the clues of the ancient past. They piece together information from rocks - how rocks form, how they change over time, and what environments they represent - in order to know which layers of rock might contain fossils. They must understand animal and plant anatomy, physiology, and behavior in order to interpret the fossils they find. With an understanding of the relationships between organisms and their environment, paleontologists become paleo-ecologists and can create images of entire ancient ecosystems. Because the past can never be recreated, paleontological resources are considered nonrenewable and are in need of protection and preservation.

Studying the fossil bones of animals from the Triassic enables paleontologists to discover what the animals ate, how they moved, their size etc. and develop a bigger picture of life on Earth over 200 million years ago.

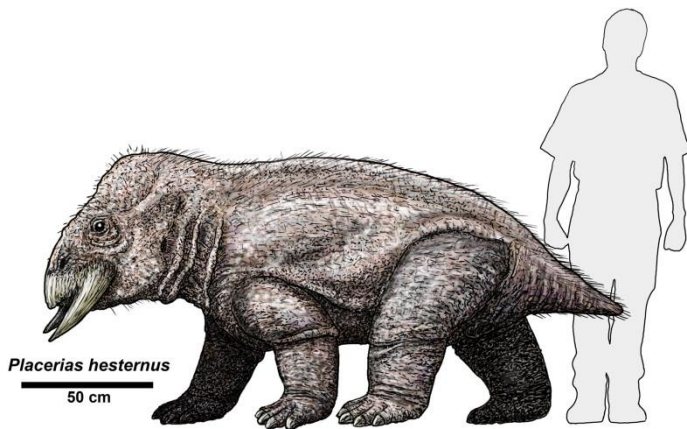
Animals of the Triassic:

Archosauriformes are a specialized group of reptiles that includes birds and crocodiles. In the Triassic, archosauriformes were represented by aetosaurs, phytosaurs, rauisuchians, and dinosaurs.



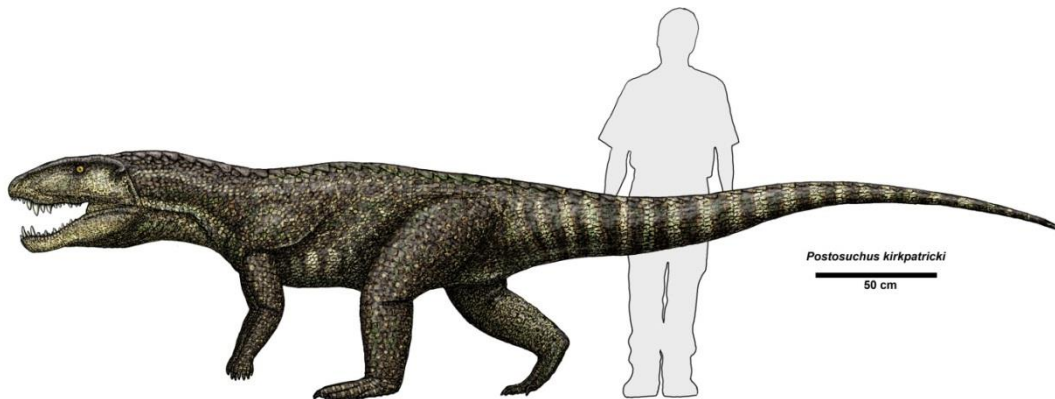
Metoposaurs (meh-toe-poe-sores) were giant amphibians. A common fossil animal found in the lower portion of the park is the large flat-headed amphibian *Koskinonodon perfectum*, 10 feet (3 m) long and weighing up to half a ton. These animals were most likely voracious predators feeding on fish and smaller animals. With their flat heads and upward directed eyes, *Koskinonodon* probably settled in the muddy bottom of ponds and

ambushed prey from below. *Koskinonodon* rarely occurs in the northern section of the park, which contains sediments younger than the Blue Mesa and Rainbow Forest. Giant amphibians are represented in these layers by a smaller yet similar animal named *Apachesaurus gregorii*.

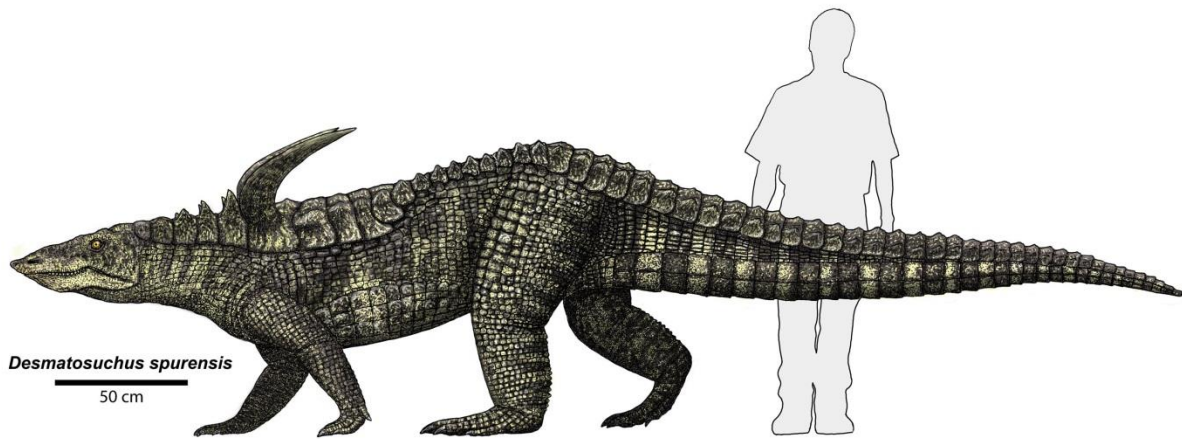


Therapsids were large reptiles that possessed mammalian characteristics including a “cheek” bone, enlarged canine teeth, pelvis, and a specialized attachment of the skull to the spine. *Placerias hesternus* (pla-seer-ee-us) was a dicynodont therapsid. This massive plant eater was up to 9 feet (2.7 m) long and might have weighed as much as two tons. Placerias had a short neck, barrel-shaped body, small tail, and a

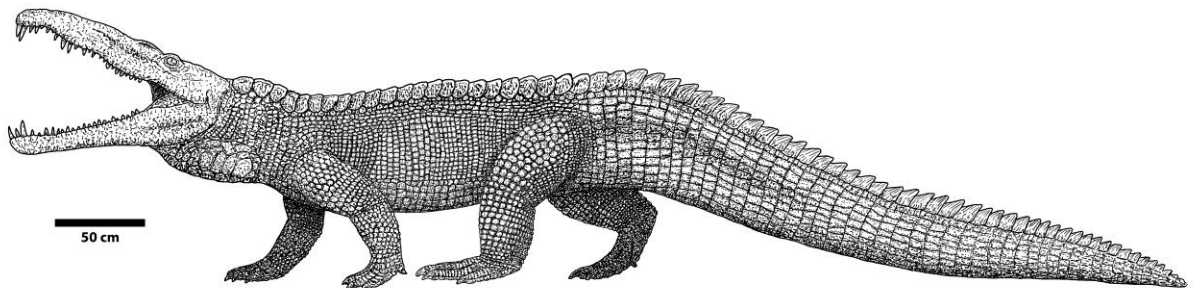
beak-like skull with large tusk-like bones protruding from its upper jaw. The beak-like jaws helped them pull up and tear tough plants and roots. While Placerias is represented in the park by isolated elements, it is common near St. Johns, just southeast of the park, where large numbers of Placerias were found in a single quarry.



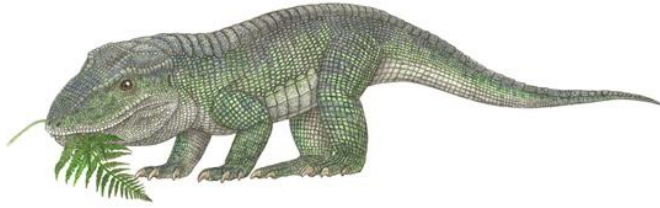
Rauisuchians (rau-i-su-key-ans) were the top terrestrial predators of the Late Triassic, thanks to huge skulls armed with powerful biting jaws and 3 inch (7.6 cm) long serrated teeth. Species of rauisuchians found in the park include *Postosuchus kirkpatricki* and *Poposaurus gracilis*. Some rauisuchians could grow up to 20 feet (6 m) in length.



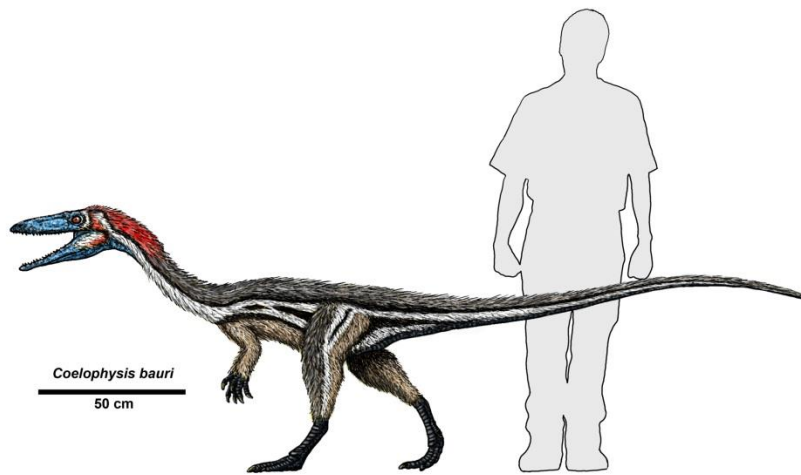
Aetosaurs (a-ee-toe-sores) were 3-18 feet (1-6m) long, herbivorous reptiles with broad flat bodies protected by plate-like scutes. Some species had large spikes on their sides or back that were possibly used for defense. Aetosaurs had short limbs and small skulls with a pig-like snout for rooting in soil for plants and roots. *Desmatosuchus spurensis* (above) and *Calyptosuchus wellesi* are two of the aetosaurs found in Petrified Forest National Park.



Phytosaurs (fie-toe-sores) were crocodile-like reptiles, some species reaching lengths possibly exceeding 20 feet (6.1 meters). Distantly related, phytosaurs probably filled similar ecological niches as crocodiles, feeding mainly on fish and any other animals that came too near. Phytosaurs are the most common fossil animal found in the park, species including *Smilosuchus gregorii* and *Machaeropsopus pristinus*.



Revuetsaurus callenderi is a small, about 3 feet (1 m) long, herbivorous reptile that until recently was quite an enigma. Known only from distinctive leaf-shaped teeth it was thought to be a primitive plant eating dinosaur. Discovery of the skeleton of this animal in Petrified Forest in 2004 showed that it was not a dinosaur and instead more closely related to aetosaurs and rauisuchians.



Dinosaurs- Most visitors to the park are surprised to learn that dinosaurs are a relatively rare and minor component of the Triassic fauna preserved at the park. Separated from the other archosaurs by characteristics of the pelvis and ankle, Late Triassic dinosaurs were mainly small, bipedal carnivorous predators including *Chindesaurus* and *Coelophysis*.

Coelophysis (sealo-fie-sis) was an early carnivorous dinosaur that probably walked on two legs. It was about 8 feet (2.4 m) long and could weigh 50 pounds (23 kg).

Paleontological research continues today in the park. There are two full time paleontologists on staff, as well as a geologist, fossil preparators, and a museum curator. Scientists and students from several universities also visit the park with research permits to discover fossils and to study the geology. New species of Triassic flora and fauna are studied each year. There is a lot more yet to learn about this ancient environment.

Related Vocabulary

- **Anatomy:** the branch of science concerned with the structure of living organisms' bodies and bones
- **Carnivore** – an animal that feeds on meat; typically has teeth that are long and pointed or serrated for tearing and separating flesh

- **Chinle Formation** - rock formation within Petrified Forest National Park and the larger area of the Painted Desert, containing several distinct rock layers, dating to over 200 million years ago; represents the Late Triassic Period
- **Erosion** - the movement of earth material from one place to another due to forces such as water, wind, gravity, or ice movements
- **Fossil** - any record of past life found preserved in rock; can be plant materials such as stems, seeds, or cones, and pollen, or animal parts such as bone, shells, or teeth; can be trace impressions, such as tracks, footprints, trails, burrows, leaves, etc.
- **Fossilization** - a process by which plant and animal remains or their impressions are preserved in rock (*evidence of life preserved by a geologic process*)
- **Geology** - a science that concentrates on the origin, history, and structure of the earth including the study of rocks and the forces acting upon the earth
- **Herbivore** – an animal that feeds on plants; typically has teeth that are flat or have triangle shaped tips for chewing and grinding
- **Igneous** – (of rock) having solidified from lava or magma; relating to or involving volcanic processes.
- **Metamorphic** - rock that has undergone transformation by heat, pressure, or other natural agencies
- **Omnivore** – an animal that feeds on both plants and meat; Typically has a combination of flat and pointy teeth
- **Organic material** - dead plant and animal matter in various stages of decomposition or fossilization
- **Permineralization** - fossilization through in-filling of pore spaces in organic material by minerals; organic material is encased within the mineral (scientific term for petrification)
- **Sedimentary** - rock formed from the deposition, accumulation, and cementation of sediments, usually forming layers, often including fossils
- **Tetrapod:** a four-footed animal, especially a member of a group that includes all vertebrates higher than fish.
- **Triassic Period** - the first geologic timespan within the Mesozoic Era, dating from 248-206 million years ago; the Late Triassic Period is well represented at Petrified Forest National Park

Ecology

Petrified Forest National Park is part of a grassland environment. Different habitats also exist as smaller areas within the grassland. The animals and plants that live in each kind of habitat change with different natural conditions. These natural conditions can include different types of soil, if drinking water is available, and how high the land is above sea level.

Land that is next to rivers, streams, and washes (streams that only have water after rain or snow) is called a riparian habitat (*rye-pair-eyan*). These areas have more plants growing in them than land not next to water. Most of the land in Petrified Forest is either shortgrass prairie where more grass grows or steppe grassland where more shrubs grow.

There are also human made habitats in the park. The picnic area at the Painted Desert Visitor Center has lots of bushes, trees, and a water fountain. These things were added by humans when the buildings were made.

Animal life at Petrified Forest includes amphibians (*am-fib-eyans*), birds, insects, spiders, mammals, and reptiles. Birds, lizards, and rabbits are the animals people see most often. Different animals can be seen during different times of day, seasons, and in different weather.

Many animals are more active within a specific range of temperatures. Crepuscular (*kreh-puss-q-lar*) animals are active at dawn and dusk (also called twilight). These are the times of day when the coolest temperatures occur. The half-darkness of twilight also makes prey animals less visible which helps keep them safe from predators. The visibility during twilight is still good enough for prey animals to find their own food though.

An animal's activity level can also change with the seasons. Snakes and lizards are diurnal (*die-urn-al*) in late spring and early fall, becoming more active during the day, but they become crepuscular during the heat of summer.

Many animals in the park are nocturnal (active at night). This is an adaptation that helps them avoid high summer temperatures as well as certain predators.

Meet the Animals of Petrified Forest

Amphibians: Can you imagine living under the ground for nine months of the year, not eating, drinking, or using the bathroom? Amphibians are amazing animals that do just that!

It is hard to imagine how animals that need to be wet all the time can survive in the dry climate of Petrified Forest, but they do. How?

Amphibians have survived and adapted in many different environments around the world by absorbing water through their skin instead of drinking it.

There could
be toads
right under
your feet!



One kind of amphibian living in Petrified Forest is the Spadefoot toad. They are named spadefoots because of a black spade shaped spot that they have under their back feet. They, and other toads, survive by absorbing water from the soil where they hibernate for most of the year. Having skin that absorbs water also means that they lose water through their skin. This water evaporation causes toads to get cold and is why you often see them sitting on warm pavement at night.

The time to spot these slippery little guys is in the summer when afternoon thunderstorms provide the rain they need to safely come out of their burrows.

Let's meet some other amphibians living in the park.

I am a Tiger Salamander - *Ambystoma tigrinum*



I am a Great Plains Toad - *Anaxyrus (Bufo) cognatus*



I am a Red-spotted Toad - *Anaxyrus Bufo punctatus*



I am a Woodhouse's Toad - *Anaxyrus*



I am a Couch's Spadefoot Toad - *Scaphiopus*



Birds:

Like many national park areas, Petrified Forest National Park gives birds a place of protection where they can find food and shelter that they might not find in other places. Petrified Forest National Park is like a natural highway dotted with bird hotels and restaurants that birds can use when they travel between habitats.

Petrified Forest has many different kinds of habitats for birds. Raptors, songbirds, and ground birds can be found in the grassland areas. Riparian areas provide food and shelter for warblers, vireos, avocets, killdeer, and others. The exotic and native plants around the Visitor Center and Rainbow Forest Museum provide homes for western tanagers, hermit warblers, and house finches.

Birds also help us learn about the health and safety of our environment. By watching birds, making observations of different species and their patterns of movement, we can better understand the changes in our environment.



Here are some common birds of the park:

I am a Horned lark - *Eremophila*



I am a Western Tanager- *Piranga*



I am a Say's Phoebe - *Sayornis*



I am a Common Raven - *Corvus*



Plants: Not all plants at Petrified Forest National Park are fossils like the petrified wood. Living plants are very important pieces to the grassland ecosystem of the park. Plants capture particulate dust in the air, filter pollution out of the air, change carbon dioxide to oxygen so animals can breathe, provide habitat for



Purple Aster

animals, and supply raw materials for humans to eat and make things.

Plants that grow in areas without a lot of rain or snow have adaptations to help them survive. There are two main families of plant adaptations. Some plants are called *drought escapers* and some are called *drought resistors*.

Plants such as the Purple Aster are drought escapers and can escape low water conditions by becoming dormant when water isn't available.

Drought escaping plants are usually annuals, growing only when enough water is available during their year-long life cycle. Seeds from these kinds of plants can stay dormant in soil for years if there isn't enough water for germination. Most grasses and wildflowers are drought escapers.



Prickly Pear Cactus

Drought resistors are usually perennials and can grow for many years. They have adaptations that help them live through times without water. For example, some will drop their leaves if water is unavailable so the plant has less material to keep healthy. Many drought resisting plants have small hairy leaves which reduce the amount of water lost to evaporation. Cacti, yuccas, and mosses are examples of drought resistors. Yuccas have long taproots which can reach water deep in the ground. Mosses can live in complete dehydration but instantly wake up and become green when rain falls.

Watch this in action here:

<https://www.facebook.com/PetrifiedForestNPS/videos/vb.290844680951415/804071072962104/?type=2&theater>



Grasses are one of the most important plants within the grassland ecosystem in the park. Individual grasses sprout almost anywhere they can find soil, even in potholes filled with dirt. Because of this they help prevent erosion of the land by holding the soil together. Most grasses fit into two basic groups, *bunch grass* and *sod-forming grass*. Bunch grass grows in scattered clumps. Examples of bunch grass include rice grass and needle-and-thread grass. Both of these grasses are perennial and become dormant during droughts. Rice grass plants have been known to live over 100 years, through wet and dry times. Sod-forming grass is what most people have in their yards. Galleta and blue grama are sod-forming perennials in Petrified Forest National Park that usually grow together.



Lichens: In many areas of Petrified Forest National Park, large areas of exposed rock surfaces are covered by lichens. Lichen is actually a simple community of at least two organisms: fungi and green algae. When both organisms depend on the other for survival, they are called symbiotic (*sim- bye-ott-ick*). Green algae use the photosynthesis process to make food for the fungus, and the fungus protects the algae from the elements while taking nutrients from soil and rock. Lichens are stronger than either fungus or algae alone.

Lichens are well adapted to dry climates. They can continue making food at any temperature above freezing. Lichens can also absorb more than their own weight of water. Because lichens take everything they need from the air, they depend on clean air. Scientists use lichens to study the quality of the air by looking at how healthy the lichens are in an area.

Here's a fun story to help remember what lichens are made of.

Alice Algae and Freddie Fungus became friends

Alice cooked the food with photosynthesis

Freddie built a house from dirt

they took a 'lichen' to each other

and their friendship stays strong on the rocks.



Wildflowers:

Wildflowers have adapted to the dry climate at Petrified Forest National Park in many different ways. Thick, waxy coverings on leaves and stems reduce evaporation. Their small leaves have less surface to catch the sun which reduces water loss. Deep taproots reach far into the soil to find water and wide reaching shallow roots catch surface water quickly. Wildflowers can also avoid drought and heat by hiding in the soil as seeds or bulbs for many years. Germination of seeds only occurs after enough rain has fallen.

April and May, following winter snow and rain, are usually the best months to see wildflowers throughout the Southwest. Starting in late August, if the summer has brought enough rain, different species of wildflowers bloom and the landscape is colorful once again.

Trees and Shrubs:



There are very few trees in the grasslands of northern Arizona. Piñon and juniper trees can be seen on high land formations like mesa tops. These trees have also adapted to survive in high winds and low water conditions. Once these plants are established they are very tough and strong. Their roots will split rocks in search of nutrients, and many can live for over 100 years. Large cottonwood and willow trees are common in riparian areas.

The juniper tree is the classic arid-land tree. When water is low, a juniper tree can stop the flow of fluids to some outer branches so it has a better chance for survival. Scale-covered leaves and bluish, waxy-coated seeds help the tree keep water inside itself.

Piñon pines often grow in the same areas as junipers. Like juniper, piñon pines grow very slowly. Some trees with 4-6 inch diameter trunks that are only ten feet tall may actually be 80 to 100 years old. Their root systems are sometimes as wide as the tree is tall. Piñons produce compact cones that contain tasty, protein-rich seeds called pine nuts. Native people still rely on this tree as an important source of food. One pound of piñon nuts has more than 3,000 calories. Many animals, such as ground squirrels, also like the seeds as a tasty and nutritious food.



Shrubs are also important members of the grassland community. Both shrubs and trees provide shelter and food for many species of animals.

The most common shrubs in the park are saltbush and sagebrush. They both have grayish green leaves and can grow relatively large.



One of the largest shrubs in the park is the cliffrose which has sweet smelling pale yellow flowers in the spring and summer.



Rabbitbrush also has pretty yellow flowers.

Abiotic – the non-living factors of an ecosystem, including sunlight, temperature, wind patterns, and precipitation

Adaptation - an alteration or adjustment by a species that enables it to improve its condition in relation to its environment

Amphibian - an animal (such as a frog or toad) that can live both on land and in water. Amphibians are born under water and start to breathe with gills but then develop lungs as they get older.

Annual plant – a plant that completes its life cycle in one year; from germination to making seeds

Biology - the study of living organisms (divided into many specialized fields that cover the morphology, physiology, anatomy, behavior, origin, and distribution of organisms)

Biotic – the living factors of an ecosystem, including the relationships between organisms

Carnivore – an animal that typically eats only meat

Climate - the average conditions of the weather in a particular place over a period of more than 10 years as shown by temperature, wind velocity, and precipitation.

Crepuscular – used to describe an animal that is most active during twilight hours

Ecology - the branch of biology that studies the relationships of organisms to each other and to their physical surroundings

Desert - arid land usually with sparse vegetation; especially such land having a very warm climate and receiving less than 25 centimeters (10 inches) of rainfall annually

Diurnal – used to describe an animal that is active during the day and sleeps at night

Dormant - having normal physical functions suspended or slowed down for a period of time; in or as if in a deep sleep.

Ecosystem - a biological community of interacting organisms and their physical environment.

Environment - the complex of physical, chemical, and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.

Evaporation - the process of a substance in a liquid state changing to a gaseous state due to an increase in temperature and/or pressure.

Germination - the process by which a plant grows from a seed; also the growth of a spore-ling from a spore for fungi

Grassland - an area, such as a prairie, in which the natural vegetation consists largely of perennial grasses, characteristic of semiarid climates

Habitat - the place where a plant or animal usually lives or grows

Herbivore – an animal that eats only plants, typically has flat teeth for grinding

Hibernate – the act of being dormant (inactive) during the winter (animal or plant); a partial hibernation for animals is called torpor.

Mammal – an animal with a spine that is able to regulate its own temperature and is in a group of animals that has hair or fur, provides milk for the nourishment of young (females), and (typically) gives birth to live young.

Nocturnal – used to describe an animal that is active at night and sleeps during the day

Observation - the act of watching, listening, and paying close attention to something in order to gather information

Omnivore – an animal that eats both meat and plants; often depending on what food is available.

Organism - an individual animal, plant, or single-celled life form

Perennial plant – a plant whose lifespan is more than two years; often going through multiple life cycles

Photosynthesis – The process by which green plants, and some other organisms, use sunlight to make food from carbon dioxide and water. This process creates oxygen as a byproduct.

Predator – an animal that hunts and kills other animals for food.

Prey - an animal that is hunted and killed by another animals for food

Species - a group of living organisms with similar characteristics that are able to breed with each other.

Reptile - an animal (such as a snake, lizard, turtle, or alligator) that cannot regulate its own temperature, lays eggs, and that has a body covered with scales or hard parts

Riparian – relating to or located on the banks of a river or in a wetland. ‘riparian habitat’

Common Animals

Amphibians

Ambystoma tigrinum Tiger Salamander

Anaxyrus (Bufo) cognatus Great Plains Toad

Anaxyrus Bufo punctatus Red-spotted Toad

Anaxyrus (Bufo) woodhousii Woodhouse's Toad

Scaphiopus couchii Couch's Spadefoot

Spea multiplicata Mexican Spadefoot (formerly *Scaphiopus multiplicata*)

Reptiles

Well adapted to the often dry environment of the region, reptiles play an important part in maintaining the health of the ecosystem. Over sixteen varieties of lizards and snakes make Petrified Forest their home. Reptiles occupy a variety of habitats ranging from grassland to rocky slopes. They consume large quantities of insects, spiders, scorpions, other reptiles and small mammals, thereby preventing infestations of any single species. Respecting the entire reptile community helps preserve this balance.

Ambystoma tigrinum Tiger Salamander

Anaxyrus (Bufo) cognatus Great Plains Toad

Anaxyrus Bufo punctatus Red-spotted Toad

Anaxyrus (Bufo) woodhousii Woodhouse's Toad

Scaphiopus couchii Couch's Spadefoot

Spea multiplicata Mexican Spadefoot (formerly *Scaphiopus multiplicata*)

Spea bombifrons Plains Spadefoot

Snakes

Arizona elegans Glossy Snake

Crotalus viridis viridis Prairie (Hopi) rattlesnake

Hypsiglena torquata Nightsnake

Lampropeltis getula Common Kingsnake

Lampropeltis triangulum Milksnake

Masticophis taeniatus Striped Whipsnake

Pituophis catenifer Gophersnake

Thamnophis cyrtopsis Black-necked Gartersnake

Lizards

Aspidoscelis pai Pai Striped Whiptail (formerly *A. inornatus* Little striped whiptail)

Aspidoscelis neomexicana New Mexico Whiptail

Aspidoscelis velox Plateau Striped Whiptail

Crotaphytus collaris Eastern Collared Lizard

Holbrookia maculata Lesser Earless Lizard

Phrynosoma hernandesi Greater Short-horned Lizard (formerly *P. douglasii* Short-horned lizard)

Sceloporus graciosus Sagebrush Lizard

Sceloporus tristichus Plateau Lizard (formerly *S. undulatus* Eastern fence lizard)

Uta stansburiana Common Side-blotched Lizard
pea bombifrons Plains Spadefoot

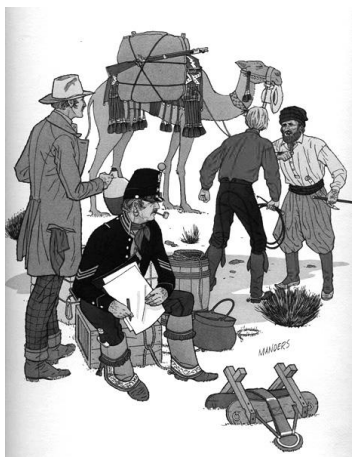
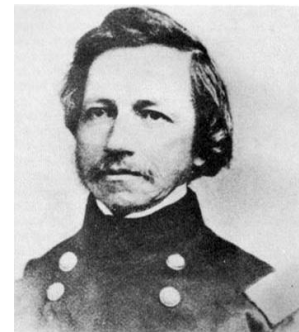
History



Standing at the edge of a colorful sea of badlands and mesas, a Spanish explorer named the region El Desierto Pintado—the Painted Desert. No mention was made of petrified wood, but the Spanish of the 16th through 18th centuries were focused on finding routes between their colonies along the Rio Grande and the Pacific Coast. Within Petrified Forest National Park, Spanish inscriptions have been discovered from the late 1800s, descendants of some of the earliest non-American Indian settlers in the region.

Explorers and Pathfinders

Routes continued to be explored after the Southwest became part of U.S. territories in the mid-1800s. U.S. Army Lt. Amiel Whipple, surveying for a route along the 35th Parallel passed down a broad sandy wash in the red badlands of the Painted Desert. Impressed with the deposits of petrified wood visible along the banks, Whipple named it Lithodendron (“stone tree”) Creek, the large wash that bisects the Wilderness Area of the park today.



One of the strangest sights at the edge of the Painted Desert must have been a camel caravan. An experienced explorer, E. F. Beale was hired by the US Government as a civilian contractor to build a wagon road along the 35th Parallel. Between 1857 and 1860, Beale made several trips from his ranch at Fort Tejon, California, building and improving the road. On his first journey, Beale was in charge of a government experiment in desert transport that included camels and their drivers. While Beale became convinced of the camels’ value, the government declared the experiment a failure. The wagon road lives on, still visible in spots across the Southwest, part of which is on the National Register of Historic Places.

From Trails to Rails and Roads



Did you know that many of the roads near the park are following the 35th Parallel? Interstate 40 is only the most recent thoroughfare along this route. In the late 1800s, settlers and private stage companies followed this ancient corridor.

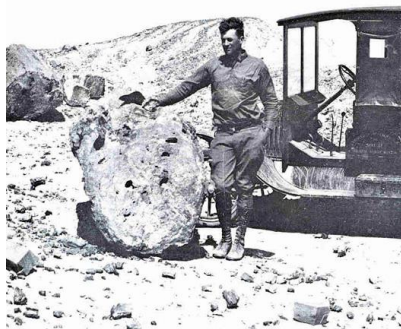
Homesteaders developed ranches that took advantage of the rich grasslands that would forever bear the mark of grazing. In 1884, the Holbrook Times noted: "...The whole northern portion of the territory

seems to be undergoing a great change...Our plains are stocked with thousands of cattle, horses and sheep..." Cattle would graze in Petrified Forest until the mid-1900s and ranches are some of the park's best neighbors.

While traveling through the park, you will see a bridge arching over a long stretch of railroad. The Atlantic and Pacific Railroad laid lines in this region in the early 1880s, sparking the founding of many northern Arizona towns, including Holbrook to the west. Adamana was the nearest town attached to what was then called the Chalcedony Forest, providing a train station, hotels, and tours. The Atchison, Topeka and Santa Fe Railway took over the line, eventually becoming today's Burlington Northern and Santa Fe Railway. While the heyday of tourist travel by train is gone, still more than sixty trains a day pass through the park.



Researchers' Paradise



Imagine being one of the first scientists to view the landscape. Geologist Jules Marcou was a member of the Whipple Expedition of 1853. He was the first to note that the trees were from the Triassic—"We are in the middle part of the Trias." In 1899, paleobotanist Lester Frank Ward came to study this natural phenomenon. His report to the U.S. Geological Survey extolled the abundance, beauty, and especially the scientific worth of the petrified wood and thus promoted the establishment of a park.

In the vast collection of fossils at the Museum of Paleontology at the University of California at Berkeley, there is a phytosaur fossil skull with odd burn marks,

discovered near Blue Mesa by Ynez Mexia in 1919. On its journey back to the University, the skull was mistaken as trash, barely escaping the hotel garbage incinerators at the Grand Canyon. Mexia's collection of bones piqued the interest of Miss Annie Alexander, founder of the Museum. In 1921, Miss Alexander and her long-time companion, Miss Louise Kellogg, visited Blue Forest, collecting the remainder of the phytosaur skull as well as other specimens. Their pioneering work came to the attention of paleontologist Charles Camp, who oversaw excavations over the next decade at sites that continue to yield valuable information about Late Triassic life.

At the beginning of the 1900s, archeologist Walter Hough collected artifacts and conducted excavations as part of the first professional archeological expedition in the area. He identified the importance of sites such as Puerco Pueblo. The Civil Works Administration funded surveys of sites in Petrified Forest during the 1930s by archeologists H. P. Mera and C.B. Cosgrove. These scientific pioneers opened the region for many generations of researchers.

The heyday of another travel line is long past as well, that of Route 66 which was decommissioned in 1985. Petrified Forest is the only national park that preserves a section of the famous road within its boundaries, now mostly just a whisper through the grasses. Route 66 was developed from part of the original transcontinental road, the National Old Trails Highway, which connected many historic trails from the East to the West Coasts. Route 66 is better known perhaps due to songs and tales of the romance of the road. That romance still continues for many as they follow Interstate 40 across the continent, exploring such places as Petrified Forest National Park.

Preserve and Protect



With the influx of tourist and commercial interest in the petrified wood during the late 19th century, residents of the region became concerned that this unique resource might disappear. In 1895, the Arizona Territory legislature petitioned Congress for the area to be a national park, a failure but was still a move towards preservation.

On June 8, 1906, the Antiquities Act was signed by President Theodore Roosevelt, to preserve and protect places of scientific importance. Petrified Forest was one of the first places set aside as a national monument through the use of this Act on December 8, 1906.

Between 1934 and 1942, the Civilian Conservation Corps helped improve the park, working on such projects as building facilities, roads, and trails. During this time, a section of the red part of the Painted Desert was added to the park. Petrified Forest continued to evolve over the years, boundaries changing, lands added. In 1962, Petrified Forest was designated a national park.

With the signing of the Wilderness Act by President Lyndon B. Johnson on September 3, 1964, the National Wilderness Preservation System was established. Six years later, one of the first

wilderness areas in the National Park System was designated within Petrified Forest National Park. Wilderness is a place where natural processes are the primary influences and human activity is limited.

On December 3, 2004, President George W. Bush signed the bill authorizing expanded boundaries for Petrified Forest National Park. As funds are available, the expansion will enlarge the park from 93,533 acres to approximately 218,533 acres, an increase of 125,000 acres. These new lands will provide more opportunities for exploration and discovery for future generations.

Archeology



People are what make archeological and historic places interesting. Who were they? How did they live? What did they leave behind? Through examination of material remains, like remnants of ancient walls, artifacts, traces of roads, and even symbols on rock, researchers pull together stories of the past. Petrified Forest National Park has a remarkably diverse and long human history. Evidence shows there are over 13,000 years of human occupation. People first came to the area in nomadic groups following the

last Ice Age, and have been present ever since.

Petrified Forest National Park contains a complex array of archeological resources, including petroglyphs that illustrate a 10,000-year continuum of human land use. Subtle but challenging landforms influenced human movements on both north-south and east-west routes from prehistoric times to the present, affecting regional patterns of settlement, trade and migration. Shifting cultural boundaries in this area created a high diversity of cultural sites and features still important to American Indians of the region today.

- Evidence of ongoing use and occupation spans paleo-Indian culture to American Indian culture today. Types of resources include hunter/gatherer sites and early large pithouse villages with an outstanding collection of the earliest pottery in the region. Evidence also illustrates the interaction between people and their environment, for example cultural landscapes, utilization and trade of petrified wood as lithic material, and human relationships to ephemeral sources of water. Examples of archeological resources that are on the National Register of Historic Places include Agate House Pueblo, Puerco Ruins and Petroglyphs, Flattops Site, and Twin Buttes Archeological District.

- The park encompasses thousands of documented petroglyphs and hundreds of pictographs of high integrity. Many petroglyphs are related to sociopolitical boundaries of the overlapping cultures, and also include a wide variety of solar calendars, which illustrate human interaction with the landscape, awareness of astronomy (thus the importance of dark night skies). Examples of petroglyphs that are on the National Register of Historic Places include Painted Desert Petroglyphs and Ruins Archeological District, Newspaper Rock Petroglyphs Archeological District, and Puerco Ruins and Petroglyphs.
- The area is a crossroads of trade routes, as evidenced by one of most diverse array of ceramics in the U.S., as well as the presence of marine shell, obsidian, and varied architectural styles.
- The cultural significance of this landscape extends from ancestral peoples through modern day native peoples (Hopi, Zuni, Navajo, and Apache), and relates to concepts of “homeland” and ancestral territory.

The continuing importance of the park’s heritage resources to associated people – the abundant evidence of use and occupancy in what might seem to some as an uninhabitable land – offers opportunities to explore the powerful and complex concept of “homeland.”

Archeological Time - The archeology of Petrified Forest National Park tells us much about human adaptation in a difficult and sometimes harsh environment. People have been coming to the area for thousands of years to hunt, gather wild foods and medicines, obtain resources like petrified wood to make tools, grow domesticated crops, and for ceremonial reasons. Many archeological sites are located on the grasslands and mesas of the lower Puerco River where loam, sand, and clay soils can support plants, wildlife, and domesticated crops. These resources were vital to the existence of the people.

The region along the lower Puerco River is considered by archeologists to be a contact area for the ancestral Pueblo people and the Mogollon cultures. This interaction among people is based on pottery designs, ceramic styles and petroglyphs that have been found in and around the park. Archeological time periods represented at the park include:

Archeological Time Periods

Paleo-Indian –

The Paleo-Indian time period dates from 11,500-8,000 years ago (9500 B.C.-6000 B.C.) and marks a time of great migrations. Paleo-Indians traveled in groups gathering wild food and hunting big game animals such as mammoth, giant sloth, and large bison. Hunting was done with spears tipped with long, fluted projectile points which archeologists call Folsom points. Little evidence of Paleo-Indian life exists because of their migratory lifestyle. Archeological sites include kill sites and camps in natural rock shelters or tents made of hides or brush. At this time, no kill or camp sites have been documented at Petrified Forest National Park. However, several

Folsom points have been found in the park, including at least one made of petrified wood dating to over 10,000 years ago (before 8000 B.C.).

Archaic - The Archaic time period dates from 8,000-2,500 years ago (6000 B.C.-500 B.C.) and marks a change in how people used the land. The Archaic people used a wide variety of native plant resources and began to hunt smaller animals. Instead of following big game during migrations, the people moved by the seasons, when plants like ricegrass, prickly pear, and piñon pine were available and ripe. Smaller spears and points were made to hunt smaller game such as pronghorn, rabbits, and birds. Hunters also began using a spear thrower called an atlatl that helped them throw farther and with better accuracy. People returned to the same areas year after year to gather plant resources. Several Archaic camps have been found at Petrified Forest National Park.

Basketmaker - The Basketmaker time period dates from 2,500-1,200 years ago (500 B.C.-A.D. 800) and marks a time of rapid population growth in the Southwest due to the introduction of agriculture (farming). Farming requires planting, care, harvest, and storage of products. People lived in semi-permanent structures, such as pithouses, built close to farm land. Pithouses were homes built into shallow or deep pits in the ground, roofed with poles tied together, and covered with thick brush and mud. They contained the tools and features necessary to plant, care for, harvest, cook, and store domesticated corn, beans, squash, and wild plant foods. The term Basketmaker comes from the finely woven baskets found at archeological sites. Their baskets were used for cooking and storing harvested and farmed plant products. Early forms of pottery were also developed during this time period.

Pueblo - The Pueblo time period dates from 1,200-600 years ago (A.D. 800-A.D. 1400) and marks the continued growth and development of a culture based on farming. Pottery also became much more complex. People began to construct pueblos as year-round dwelling structures. These above ground, stone-walled rooms were arranged like villages, with storage rooms for storing food, an open activity area in the middle called the plaza, underground rooms called kivas, and outer-lying field houses for shelter and tool storage. Most pueblo dwellings at Petrified Forest National Park face the south or southeast and are found on hilltops and ridgelines.

During Pueblo times there was more contact with other people living throughout the Southwest. This was in the form of trade for information, pottery, food, and raw materials such as petrified wood, shell, and turquoise. Archeologists study trade patterns and objects to better understand prehistoric social interactions and economic systems. A popular pueblo within the park is Agate House in the Rainbow Forest. This structure was partially reconstructed in the 1930's by the Civilian Conservation Corps under the guidance of an archeologist and is listed on the National Register of Historic Places for its significance in understanding prehistory in the area. The walls in the eight room pueblo are unique - they are made of petrified wood. Another structure in the park is Puerco Pueblo, listed on the National Register of Historic Places for its significance in understanding prehistory in the area. Puerco Pueblo may have had 100 rooms. It was one story tall, but sometimes two to three rooms deep, with at least three kivas. The entire Pueblo was not built at the same time. Evidence shows a time of rapid population growth, perhaps through immigration, resulting in the final size of the village. The rooms surround a large plaza. Up to

200 people could have lived in this village. Near the Pueblo are trash deposits, petroglyph panels, and a petrified wood quarry.

Contemporary American Indian - The Modern American Indian tradition includes likely descendants of the ancestral Puebloan people, including the Hopi, Zuni, and Rio Grande people. These modern people have stories and traditions that include their emergence into this world and clan migrations. The tribes consider prehistoric dwellings in the Southwest to be the remains of their ancient migrations. The sites of the ancestral Puebloan people still have meaning for modern Pueblo people. These places are sacred and on traditional land and should be respected and preserved. The Navajo, or Diné, are different from the Pueblo people. During prehistoric time they lived as hunter-gatherers. However, they learned new technologies, such as weaving and farming, from their neighbors. The Navajo have sacred and traditional land and stories about their people and the journeys they made. Some stories include the region around Petrified Forest National Park. Current archeological evidence indicates that the earliest Navajo site in the park was used as a seasonal winter home during the 1700s.

Key Vocabulary for Archeology

- **ancestral Puebloan** - a term given to people living in the Four Corners region of the Southwest from approximately 1,200-600 years ago (A.D. 800-A.D. 1400); formerly called Anasazi, a Navajo word often translated as ancient enemies, the name has changed out of respect for the modern descendants of these ancient people.
- **Anthropology** - a science that holistically studies human cultures, behavior, and technology, both currently existing and extinct.
- **Archaic Period** - an archeological time period assigned to nomadic hunting and gathering people. In the Southwest this time period dates from 8,000-2,500 years ago (6000 B.C.-500 B.C); marks the development of agriculture in the Southwest.
- **Artifact** – any object made by human beings or used by human beings with a specific purpose; a hand made object such as a tool or parts of one; characteristic of an earlier time or cultural stage; object found at an archeological excavation
- **atlatl** - a tool used in spear throwing that lengthened the extension of the human arm to throw a spear harder, faster, and with better accuracy
- **Basketmaker Period** - an archeological time period assigned to prehistoric cultures of the Southwest dating from 2,500-1,200 years ago (500 B.C.-A.D. 800), named for the basketry found; people lived in pithouses and other forms of semi-permanent housing, primarily making their living from agriculture, hunting, and gathering.
- **Ceramic styles** - recognizable patterns on prehistoric pottery or ceramics that can be assigned to archeological time periods of popular use.
- **Culture** - a socially shared knowledge of beliefs, customs, technology, and rules of behavior of a group of people.
- **Folsom point** - a long, fluted projectile point distinctive of the Paleo-Indian time period.
- **kiva** - an underground ceremonial chamber used by ancestral Puebloan people for meetings, rituals, weaving, making tools and clothing, storytelling, and instruction of children; still used today by modern Pueblo people.
- **mano** - a stone object held in the hands that is used to grind corn or other seeds into meal.
- **metate** - the grindstone upon which plant material and corn is ground with a mano.

- Paleo-Indian Period - an archeological time period assigned to prehistoric cultures from 11,500-8,000 years ago (9500 BC-6000 BC) when people were hunting big game (mammoths, horses, camels, etc.) and gathering wild plants.
- pithouse - a structure with a foundation built into the ground with walls and roof reinforced by small tree trunks, branches, and mud; entry was either through a hole in the roof or through a long, narrow entry ramp.
- pueblo - masonry structure or group of structures, from the Spanish term meaning town or village; refers to a specific culture or site when capitalized.
- quarry - in an archeological context, a place where stone was obtained for the purpose of manufacturing stone tools; tools were often started at the quarry so that they would be easier to carry to another site for completion.

Suggested Reading List

The resources at Petrified Forest National Park offer a wide range of subjects to learn about. The following are some suggested books to help your class prepare for your field trip to the park.

The following books are in order from lowest to highest Lexile measure or age range (if available) within each category.

Petrified Forest General background:

- "Ranger Trails: Jobs of Adventure in America's Parks" by Lori Yanuchi – ISBN-13: 9780967017723 - Ages 6-14
- "A Day in the Life of a Park Ranger" (The Kids' Career Library) by Liza N. Burby - ISBN13: 9780823953004 – 830L, Ages 8-11
- "Discover National Monuments: National Parks" (Discover Your World) by Cynthia Light Brown - ISBN-13: 978-1934670286 – Ages 9-12
- "Petrified Forest: A Story in Stone" by Sidney R. Ash and T. Scott Williams - ISBN-13: 978-0945695110 - 1140L
- "The Painted Desert: Land of Light and Shadow" by Rose Houk and George H. H. Huey – 1600L

Paleontology and Fossils:

- "It Could Still Be a Rock" (Rookie Read About Science) by Allan Fowler – Grades K-2
- "Fossils Tell of Long Ago" by Aliki - ISBN13: 9780064450935 – 480L, Grades K-2
- "Figuring out Fossils" by Sally M. Walker - ISBN13: 9781467707916 – 600L, Ages 8-11
- "Paleontology: The study of Prehistoric Life – A True Book" by Susan H. Gray - ISBN13: 9780531246801 – 860L, Ages 8-10
- "Dawn of the Dinosaurs: The Triassic in Petrified Forest" by Robert A. Long, Rose Houk, & Doug Henderson - ISBN-13: 9780945695028 – 880L
- "Prehistoric Past Revealed: The Four Billion Year History of Life on Earth" by Douglas Palmer - ISBN-13: 9780520248274 – 1360L
- "A Field Guide to Rocks and Minerals" (Peterson Field Guides) by Frederick H. Pough - ISBN-13: 9780395910962

- "A Golden Guide to Fossils" (Golden Field Guide Series) by Frank H. T. Rhodes, Paul R. Shaffer, & Herbert S. Zim. - ISBN-13: 9781582381428
- "Ancient Forests: A Closer Look at Fossil Wood" by Frank J. Daniels, & Richard D. Dayvault - ISBN-13: 9780966293814

Geology:

- "Geology: The Study of Rocks – A True Book” by Susan H. Gray - ISBN13: 9780531246764 – 790L, Ages 8-10
- "The Southwest Inside Out" by Thomas Wiewandt & Maureen Wilks - ISBN-13: 9781879728059 – 1270L
- "The Colorado Plateau: A Geologic History" by Donald L. Baars - ISBN13: 9780826305985 – 1540L
- "Guide to Geologic Features at Petrified Forest National Park" by John V. Bezy and Arthur S. Trevena - ISBN-13: 978-1892001139

Biology and Environment:

- "Gas Trees and Car Turds” by Kirk Johnson & Mary Ann Bonnell - ISBN-13: 9781555916664 – Ages 8 and up
- "The Down to Earth Guide to Global Warming” by Laurie David and Cambria Gordon - ISBN13:9780439024945 – 1090L, Grade 6
- "How We Know What We Know About Our Changing Climate: Scientists and Kids Explore Global Warming (About Our Changing Climate)” by - Lynne Cherry & Gary Braasch - ISBN-13: 978-1584691037 - 1170L, Ages 10 and up
- "Teachers’ guide to How We Know What We Know About Our Changing Climate” by Carol L. Malnor - ISBN-13: 978-1584691051 – Grades 5-8
- "Shrubs & Trees of the Southwest Deserts" by Janice Bowers - ISBN-13: 978-1877856341
- "Weather in the Southwest" by Jim Woodmencey - ISBN-13: 9781583690130
- "50 Common Mammals of the Southwest" (Western National Parks Association) by George Olin

- "50 common Birds of the Southwest" (Western National Parks Association) by Richard L. Cunningham
- "50 Common Reptiles & Amphibians of the Southwest" by Jonathan Hanson, & Roseann Beggy Hanson
- "National Audubon Society Field Guide to the Southwestern States: Arizona, New Mexico, Nevada, Utah" by National Audubon Society

History, Culture, and Archeology:

- "Coyote: A Trickster Tale from the American Southwest" by Gerald McDermott - ISBN-13: 9780152019587 – 360L, Ages 4-8
- "If You Lived With The Hopi" by Anne Kamma - ISBN-13: 978-0590397261 – 760L, Ages 7- 10
- "Songs from the Loom: A Navajo Girl Learns to Weave" by Monty Roessel – ISBN13: 9780822597124 -780L, Ages 10-11
- "Stalking the Past: Prehistory at Petrified Forest " by Anne Trinkle Jones - ISBN-13: 9780945695042 – 1030L
- "Navajo Weaving Way; A Path from Fleece to Rug" by Noel Bennett - ISBN-13: 9781883010300 – 1190L
- "A Guide to Pueblo Pottery" by Susan Lamb - ISBN-13: 9781877856624 – 1350L
- "Life in the Pueblo: Understanding the Past Through Archaeology" by Kathryn A. Kamp, & Amy Henderson - ISBN-13: 9780881339642 – 1410L
- "Tapamveni: Rock art Galleries of Petrified Forest and Beyond" by Patricia McCreer & Ekkehart Malotki - ISBN-13: 9780945695059 – 1430L
- "It Happened in Arizona, Remarkable Events That Shaped History" by James A. Crutchfield – ISBN13:9781560442646 - 1480L
- "Route 66: Spirit of the Mother Road" by Bob Moore - ISBN-13: 9780873588553

Post-Visit Activity Suggestions

1. Create a National Park informational brochure:
 - What information would people need to know about a park before they visit?
 - Write to a park for information or look on their website and create the brochure on the computer or by hand with the information discovered.
2. Send a Flat Ranger to a park:
 - Templates can be found here - <https://www.nps.gov/pefo/learn/kidsyouth/index.htm>
3. Create your own National Park:
 - Research what is needed to operate a national park, monument, historic site etc.
 - What will be in the visitor center
 - Will there be trails?
 - How many rangers will you need?
 - What resources will be protected
 - Will any sciences be studied there?
 - What kind of ecosystem is the park in?
 - What kinds of plants and animals will be found there?
 - In what ways can the park balance visitor use and protection of resources?
 - Select either a real place that the students are interested in protecting or create a completely fictional park.
4. Find a place of importance that students think should be a park or monument and write a letter to congress in favor of protecting it.
 - Why is this place important? Historic, geologic, archeological, paleontological etc.
 - What resources need to be protected and why?
5. Comparative Geology:
 - Look at the geology of another region in the US and compare it to that of Petrified Forest – age, color, types of rock, kinds of fossils found, how it was formed?
 - Find another area of the world that contains Late Triassic geology and compare it to the Petrified Forest.
6. Comparative Paleontology:
 - Look at the fossils found in another region of the U.S. or the world and compare it to those found in Petrified Forest
 - What kinds of animals, plants, environment? How old are the fossils? What kinds of evolutionary relationships can be drawn between the fossils in the two areas?

7. Cultural History and Archeology:

- Compare and contrast the human history in the Southwest to other areas of the U.S. and the world.
 - Ex. What were humans doing in AZ in the 1700's compared to VA at the same time? What types of cultures existed in the U.S. 1000 years ago compared to Europe 1000 years ago.
 - Be careful not to let the students make judgments about the intelligence or sophistication of one culture verses another, creating a 'these people were better' mentality. Get them to stick to the facts.

8. Ecology:

- What is the ecosystem like in Petrified Forest and how does it compare to the ecosystem where the students live?
- Start an I-naturalist account for the school or class and start taking observations around the school. <http://www.inaturalist.org/>
- Become Backyard Observers with the National Phenology Network - <https://www.usanpn.org/>
- Research threatened or endangered species of plants and animals and how we can help.

More activities on the park website - <https://www.nps.gov/pefo/learn/kidsyouth/index.htm>